REVIEW PAPER ON SLOW MOVING VEHICLE DECTION USING IMAGE PROCESSING

A V Shivani
Dept.
Information Science and Engineering
Alva's Institute of Engineering and Technology
Mijar, Moodbidre

Abiman H R
Dept.
Information Science and Engineering
Alva's Institute of Engineering and Technology
Mijar, Moodbidre

Dhananjay Kumar P S
Dept.
Information Science and Engineering
Alva's Institute of Engineering and Technology
Mijar, Moodbidre

ABSTRACT:

Intelligent System for speed estimation of vehicle in computerized picture arrangements is one of the key advancements of Traffic Reconnaissance System with issues of broadening urban scale and expanding number of vehicles. This examination paper plans to build up the shrewd framework for speed estimation of vehicle utilizing picture preparing procedure. By and large works were the product advancement of an insightful framework that necessary a video scene and client planned calculation in MATLAB programming to actualize it. The Algorithm for vehicle speed discovery from a video outline framework comprises of six significant segments in particular, Image Acquisition, Foreground identification, Morphological activities, Vehicle location, Speed Estimation and Result Analysis. Every calculation comprises of MATLAB codes to execute every segment. The planned framework is adaptable and can be reached out for different applications. The most extreme conceivable mistake of the framework was resolved to be inside ±3 km/h and the analysis was performed on various kind of vehicles and distinctive scope of speed.

List Terms—Traffic Surveillance, Speed Estimation, Foreground Detection, Morphological Filtering.

1. INTRODUCTION

Powerful and predictable traffic reconnaissance framework is an earnest need to grow traffic control and its administration. Vehicle stream estimation gives the impression to be a significant part in observation framework. The traffic stream shows the traffic state in fixed time interim and adapts and control particularly when there's a congested road and when the speed of a vehicle makes a devastation. Canny System for Surveillance of vehicular traffic offers a setting for the extraction of critical data of traffic measurements. Programmed following of vehicle can be the establishment for some fascinating applications. A precise and strong following capacity at the core of such a framework is fundamental for building more significant level vision-based knowledge [1].

Besides, there is a need to make a savvy traffic reconnaissance framework with constant moving vehicle identification, speed estimation, proficiencies. Customarily, vehicle speed identification or on the other hand observation was acquired utilizing radar innovation, especially, radar indicator and radar firearm. This strategy still has a few impediments, for example, the cosine mistake that happens when the course of the radar weapon isn't on the immediate way of the approaching vehicle. Furthermore, the expense of apparatus is one of the significant reasons, and furthermore concealing (radar wave reflection from two unique vehicles with particular statures), and radio impedance (blunder brought about by the presence of comparative recurrence of the radio waves on which a transmission is communicated) are two other powerful factors that reason mistakes for speed recognition lastly, the way that radar sensor can follow just one vehicle whenever is another confinement of this strategy. Numerous works and endeavors have been made in vehicle identification and speed estimation utilizing video picture handling yet came up short on a novel calculation [2].

In this paper, another calculation is anticipated that exploits frontal area location and morphological separating for the speed estimation of moving vehicles in rush hour gridlock. The calculation requires a video contribution from a camera alongside camera parameters, for example, edge and opposite field of view. It further requires most recent release of MATLAB programming introduced in a high handling velocity PC.

2. SYSTEM ARCHITECTURE

The framework engineering for planning a smart traffic surveillance framework comprises of six unique segments where beginning work is Image securing where the picture is procured from a traffic reconnaissance video scene and afterward it moves algorithmically to different parts which are examined further.

3. FOREGROUND DETECTION

Forefront location is one of the principal assignments in the field of Computer Vision whose point is to recognize changes in picture successions. A normally utilized way to deal with concentrate frontal area objects from the picture arrangement is through foundation concealment, or foundation subtraction and its variations. In strong video observation applications, division of frontal area and foundation is an essential concern. Since the cameras are stationary in such applications, foundations demonstrating based frontal area recognition techniques are generally utilized [3]. Such a strategy is made out of two primary parts: demonstrating the foundation and distinguishing the frontal area. In the initial segment, a foundation model is resolved and in the subsequent part, by contrasting that foundation model with the present outline, the closer view articles are recognized. Here, we have utilized closer view identifier framework article found in MATLAB that utilizations shading or grayscale video outline and contrast with a foundation model with decide if singular pixels are a piece of the foundation or the closer view. It at that point processes a frontal area veil. Gaussian Mixture Models (GMM) idea has been utilized in Foreground Detector for bunching the focuses in video outline for foundation displaying. The GMM calculation is a decent calculation to use for the characterization of static stances and non-fleeting example acknowledgment. Utilizing GMM we can get thickness estimation for each group.

Fig. 2. Foundation Subtraction Flow Diagram. [4]

In this exploration we actualize the Gaussian Mixture Model for foundation subtraction which is heartier than different models. Above all it can deal with multi-modular circumstances for example trees and sky which is all the more adequately separated by the GMM model. Every pixel worth is displayed by a blend of Gaussian instead of a specific sort of conveyance. In light of the change of every one of the Gaussian of the blend, we decide which Gaussians may relate to foundation hues. Pixel values that don't fix the foundation disseminations are viewed as frontal area until there is a Gaussian that incorporates them with adequate predictable proof supporting it [5]. This technique is entirely versatile with lighting changes, dull movements and moderate moving articles. This technique contains 2 principle noteworthy parameters – Alpha, the learning steady and T, the extent of the information that taught to be represented by the foundation. The Gaussian blend parts for a pixel have standardized loads determined from the past perceptions [5]. The parameters of the blend parts are refreshes with the new edges. A recovered pixel worth is contrasted and all the parts of the blend allocated to that pixel to discover out if there is a match. A match is said to happen when the recovered pixel worth is inside 2.5 times standard deviation of a blend segment. The update strategy is distinctive for the coordinating segment and different segments. The mean values and the covariance frameworks are refreshed for just the coordinating segment. On the off chance that there isn't a match between the present pixel esteem furthermore, the blend parts identified with that pixel .the segment having the littlest probability concerning the current pixel worth is disposed of. Another Gaussian part is made instead of the disposed of one, having a mean worth equivalent to the present pixel esteem, and a fluctuation equivalent to a foreordained consistent [6].

3.1 Algorithm for Background Subtraction

So as to give a superior comprehension of the calculation utilized for foundation subtraction the accompanying advances were embraced to accomplish the ideal outcomes:

1. Initially, we contrast each info pixels with the mean 'mu' of the related segments. On the off chance that the estimation of a pixel is close enough to a picked segment's mean, at that point that segment is considered as the coordinated part. So as to be a coordinated part, the contrast between the pixels and mean must be less than contrasted with the part's standard deviation scaled by figure D the calculation.
2. Furthermore, update the Gaussian weight, mean and standard deviation (fluctuation) to mirror the new got pixel esteem. In connection to non-coordinated segments the loads 'w' diminishes though the mean what's more, standard deviation remain the equivalent. It is reliant upon the learning segment 'p' in connection to how quick they change.
3. Thirdly, here we distinguish which segments are parts of the foundation model. To do this an edge worth is applied to the segment loads 'w'.
4. Fourthly, in the last step we decide the forefront pixels. Here the pixels that are distinguished as frontal area don't coordinate with any segments resolved to be the foundation.

4. MORPHOLOGICAL FILTERING

Twofold pictures may contain various flaws. Specifically, the twofold locales created by straightforward edge are misshaped by commotion and surface. Morphological picture handling seeks after the objectives of evacuating these blemishes by representing the structure and structure of the picture. Morphological picture handling is a gathering of non-direct tasks identified with the shape or morphology of highlights in a picture. Morphological activities depend just on the overall requesting of pixel esteems, not on their numerical qualities, and in this manner are particularly fit to the handling of twofold pictures. Morphological tasks are utilized for the most part for the item structure improvement (arched body, opening, shutting, diminishing, object checking), picture preprocessing (shape rearrangements, extreme disintegration, commotion separating), division of article furthermore, estimation of region and border. Morphological systems test a picture with a little shape or then again layout called an organizing component. The organizing component is situated at all potential areas in the picture and it is contrasted and the relating neighborhood of pixels. The organizing component is a little twofold picture, for example a little framework of pixels, each with an estimation of zero or one. Morphological tasks apply an organizing component to an info picture, making a yield picture of a similar size. In a morphological activity, the estimation of every pixel in the yield picture is based on an examination of the relating pixel in the info picture with its neighbors. By picking the size and state of the neighborhood, you can build a morphological activity that is touchy to explicit shapes in the information picture.

4.1 Dilation and Erosion

The most essential morphological activities are expansion and disintegration. Enlargement adds pixels to the limits of items in an picture, while disintegration expels pixels on object limits. The number of pixels included or expelled from the items in an picture relies upon the size and state of the organizing component used to process the picture. Here, we have utilized organizing component of line shape, length 8 at 90 degree for enlargement while organizing component of circle shape with range 6 for disintegration.

Fig. 3. Morphological Dilation of a Binary Image. [8]

We can utilize morphological opening to evacuate little articles from a picture while protecting the shape and size of bigger questions in the picture. The morphological close activity is a enlargement pursued by a disintegration, utilizing the equivalent organizing component for the two tasks typically utilized for filling holes in an picture. In this paper, we have considered morphological separating methods for commotion evacuation, edge discovery, division, little articles expulsion, filling holes, edge smoothening, and so forth [9].

5. VEHICLE DETECTION

Vehicle detection and monitoring through video image processing is now considered as an attractive and flexible technique. In this thesis we describe a novel approach by the use of foreground detection, blob analysis, morphological filtering, to detect and monitor vehicles in real-time. In this research, we have captured a video using our mobile tied with a mechanical arm placed at a certain elevated angle with the proper measurements. The cost of setting such a system was within our budget as a student. We took many videos of difference vehicles at different speed levels and at different angle. The videos taken were processed for vehicle detection through an MATLAB algorithm. Here, we have used Blob Analysis technique that is available in MATLAB for using the filtered image frame for the detection of vehicles. Blob detection refers to mathematical methods that are aimed at detecting regions in a digital image that differ in properties, such as brightness or color, compared to areas surrounding those regions. Informally, a blob is a region of a digital image in which some properties are constant or vary within a prescribed range of values; all the points in a blob can be considered in some sense to be similar to each other [10]. In order to achieve, vehicle detection and speed estimation this proposed method tracks each blob within successive image frames returning output parameters like Area, Centroid and Bounding Box.

6. SPEED ESTIMATION

Speed Measurement is the main focus of this research paper. In this paper, we have used simple two point distance formula calculating the distance covered by vehicles between two frames and hence dividing it by the time between two frames obtained from the video. Although in this research we have taken only linear distance into consideration just to build up a prototype system and also due to limited resources. There is much more possibilities in this area than we are presenting and we can go far more in future with more resources. j = (a, b) & j -1 = (c, d) Where, the centroids location is showed in frame j and j-1 for one vehicles, with (a, b) coordinate and (c, d) coordinate. Distance, D =�$(a - c)2(b - d)2$ (1) Speed, S =Dt , where t = time between 2 frames. (2) △ t = 2 X 1 frame rate (3) Speed obtained here is in pixels per second. However, we need to convert this to kilometer per hour for speed standardization. For this we need to know the actual height of the image or perpendicular field of view of the camera which helps in conversion of pixel to meter. So, we measured all the parameter with the help of a measuring tape and inserted those values into our algorithm and we were able to standardize the speed of the vehicles and also took many data and also we took the speed of the vehicles as per given in the speedometer.

6.1 Calculation of Perpendicular Field of View

The figure below shows the camera positioning and labelling of different parameters used for calculation of perpendicular field of view.

In this research, we have used Samsung galaxy SIII for capturing the videos. From the derivation of angle of view formula we can clearly conclude the vertical angle of view [15]. So, vertical angle of view, $\theta3$ is calculated from the formula given below [7]:

$\theta3$ = 2 arctan � v
2f� (8)

Where, focal length, f = F = 31mm. Vertical dimension of 35mm image format, v = 24mm Hence, using the equation 8, we determined the vertical angle of view ($\theta3$) as 42.32 degrees. Because the image height is 240 pixels obtained from the video and calculating the perpendicular field of view or the actual image height as 26.8 meter using equation 6 where the height of the camera was measured 5m from the ground, height of the vehicle was measured 1m (approx.) and horizontal distance between the camera and vehicle was measured to be 33.5m. Comparing it to the pixel height of the image frame we got 1

7.2 Data Tables

In Table I, II and III the exploratory outcomes for speed estimation of Man, Bikes and Cars are appeared and the mistake is determined. The mistake is determined by contrasting between the distinguished framework speed and the genuine speed which is acquired from a reference vehicle. As appeared in Tables, the mistake happens in light of two reasons, first, because of the non-linearity in network opposite field of view and second, on account of the shaking of video which instigates change in channel yield

We didn't referenced all the unpredictable estimation which is as well enormous to be exhibited yet rather we closed our count what's more, displayed in the above table.

7.3 Evaluation

We test our framework with various speed levels and unique foundation models with variety in camera point and natural conditions like light enlightenment. The impact of variety in light enlightenment and other natural conditions can be limited utilizing appropriate separating techniques. We too stepped through examination for exploratory subjects utilizing night vision camera also, infrared camera and reasoned that the night conditions doesn't influence the identification unfavorably as depicted in above figures 17 &18.

Fig.17. Identification of Aerial Vehicle Using Night Vision Camera. [13]

Fig.18. Identification of Human and Dog Using Infrared Camera. [14]

Our proposed speed identification framework works equitably and accurately to quantify various speeds yet it is delicate to separating, and the sifting must be conveyed by the foundation models. After numerous experimentations on various sort of vehicles and diverse speed go, the greatest blunder conceivable of the framework was resolved not to surpass ±3 km/h.

7.4 Comparison

We paralleled our outcome with different frameworks like customary radar weapon, lieder indicator frameworks and other speed estimation systems utilizing other picture handling strategies. The radar firearm and the cutting edge lieder identifier frameworks have extraordinary unpredictability and impediment regarding the speed estimation of vehicles like:

1. The individual outfitted with radar firearm or lieder locator must not be moving all things considered to be held at static point.
2. Significant expense of the apparatus.
3. Radio obstruction influences the radar weapon framework.
4. Precision of these framework is very low [11]-[12]. There are rare research paper that utilized K-implies bunching, Edge differencing, Gaussian demonstrating with gaps filling, Kalman channel and other obsolete procedures for separating yet we found the calculation we utilized joining distinctive picture preparing procedures like closer view extraction utilizing Gaussian blend models, morphological sifting, opening filling, edge smoothening, and so forth delivered increasingly compelling outcome and could be consummated more for better results. The mistake that we found in our framework is not exactly the overarching frameworks for speed estimation. Along these lines, we can close this framework is increasingly productive and efficient than different advances utilized for speed estimation. In any case, the blunder happened can be overcome by great camera position and its solid adjustment. Because of absence of specialized and budgetary assets our exploration was restricted to its bound.

8. CONCLUSION

Vehicle location and Speed estimation is a significant crucial traffic reconnaissance framework and is additionally supple for some other picture preparing related frameworks. Anyway there is issue of converging of vehicles which can be limited improving the sifting strategies and precising the shadow expulsion of the vehicles. What's more, in this exploration just direct separation are thought about ignoring non-direct separation like roundabout, circular, and so forth. Powerful advancement of the calculation and making the framework increasingly exact and effective will be our future works. Further the calculation can be enhanced for number plate location from rapid vehicles. At long last, it tends to be presumed that speed estimation through video picture preparing is effective and efficient than ordinary radar innovation and this zone is yet that to be investigated and take profit by its wide potential outcomes. Our created calculation is only one of numerous potential outcomes of Intelligent Traffic Surveillance System and goes about as a model for progressively composite and huge framework.

REFERENCES

[1] B. Coifman, D. Beymer, P. McLauchlan and J. Malik, "A real-time computer vision system for vehicle tracking and traffic surveillance,"Transportation Research Part C,vol.6, no. 4, pp. 777-782,1998.
[2] Arash Gholami Rad, Abbas Dehghani and Mohamed Rehan Karim (2010). Vehicle speeddetection in video image sequences using CVS method, International Journal of the Physical Sciences Vol. 5(17), pp. 2555-2563.
[3] Wie Xu Yue Zhou, Yihong Gong and Hai Tao, Background modeling using time dependent Markov random field with image pyramid," in Proc. IEEE Motions'05, January 2005.
[4] Robust techniques for background subtraction in urban traffic video - SenChing S. Cheung and Chandrika Kamath, Video Communications and Image Processing, SPIE Electronic Imaging, San Jose, January 2004, UCRL-JC153846-ABS, UCRL-CONF-200706
[5] Adaptive background mixture models for real-time tracking, Chris Stafer, W.E.L Grimson
[6] Improved Post processing for GMM based adaptive background modelling by Deniz Turdu, Hakan Erdogan.
[7] Ernest McCollough (1893). "Photographic Topography". Industry: A Monthl MagazineDevoted to Science, Engineering and MechanicArts (Industrial Publishing Company, SanFrancisco): 399–406.
[8] Morphological filtering, MATLAB © 1994-2013 The MathWorks, Inc.
[9] Dr. Robert Fisher (No date). Morphological Image Processing [Online].Available:https://www.cs.auckland.ac.nz /courses/compsci773s1c/lectures/ImageProcessing -html/topic4.htm.
[10] Adnan Khashman (2008). Automatic Detection, Extraction and Recognition of Moving Objects, Intenational Journal of Systems Applications, Engineering & Development, Vol.
2, Issue 1. Pp. 43-51.
[11] Radar Detector, From Wikipedia, the free encyclopedia, http:// en.wikipedia.org / wiki/ Radar detector, November 2007.
[12] Lider Detector, From Wikipedia, the free encyclopedia, http://en.Wikipedia .org/wiki/Laser_detector, November 2007.
[13] US Military Videos & Photos (2012). 169th Fighter Wing F-16s Deploy to Afghanistan - Night Vision [Online]. Available: https://www.youtube.com/watch?v=U3RY3UzmswU [2014, June 29].
[14] thermal2nightvision (2011).Clip on thermal imager, [Online]. Available: https://www.youtube.com/watch?v=Lox156qOFDY&list=UUSmstaBfOZmdhVTUlPze3Kw&index=31 [2014, June 29.
[15] "Lens angle of view" by User: Moxfyre.
Original uploader was Moxfyre at en.wikipedia - Transferred from en.wikipedia; transferred to Commons by User: Moxfyre using CommonsHelper. (Original text: self-made based on: Image: Lens3.svg). Licensed under GFDL via Wikimedia Commons - http://commons.wikimedia.org/wiki/File:Lens_angle_of_view.svg#media viewer/File:Lens_angle_of_view.svg.